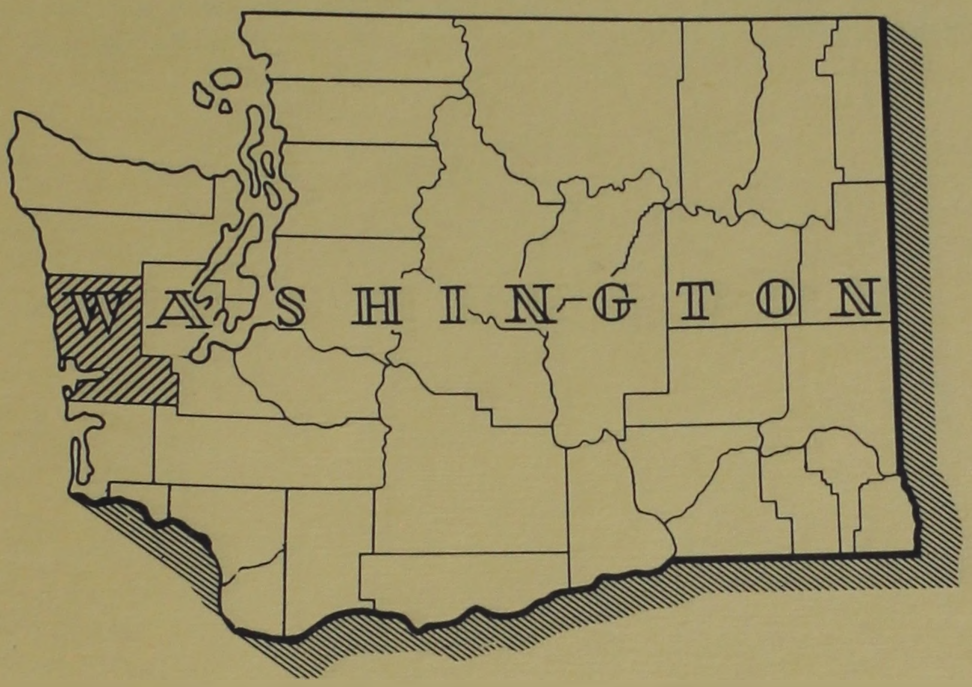
FOREST STATISTICS FOR GRAYS HARBOR CO., WASHINGTON

FOREST SURVEY REPORT NO. III



U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, DIRECTOR

PORTLAND, OREGON AUGUST 1953

PREPARED BY THE DIVISION OF FOREST ECONOMICS

F. L. Moravets, Forest Survey Resource Analyses
C. E. Mayer, Forest Survey Field Supervision

Field[1/] and Office Work in Grays Harbor County, Washington

by

C. E. Tyler
W. R. Johnson
R. B. Pope
John L. DuBay
John A. Sandor
Carl Wilson
P. A. Chapman
Ruth B. Ufen
Kathryn Flaherty
Inga E. Fulkerson
Emma G. Johnson
D. R. Gedney

1/ Acknowledgment is made of cooperation from several private and public agencies.

FOREST STATISTICS

FOR

GRAYS HARBOR COUNTY, WASHINGTON

Forest Survey Report No. 111

by

F. L. Moravets

U. S. Department of Agriculture Forest Service
Pacific Northwest Forest and Range Experiment Station

R. W. Cowlin, Director
August 1953

FOREWORD

This publication summarizes in statistical form the results of a reinventory of the forests of Grays Harbor County, Washington, conducted in 1951. This reinventory is a part of the maintenance phase of the Forest Survey, a Nation-wide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and amended June 25, 1949. The purpose of the Forest Survey is to periodically inventory the extent and condition of forest lands and the timber and other products on them, to ascertain rates of forest growth and depletion, to estimate present consumption of timber products and to analyze and make available in reports survey information needed in the formulation of forest policies and programs.

The Forest Survey is conducted in the various forest regions of the Nation by the regional forest experiment stations of the Forest Service. In the Pacific Northwest region of Oregon and Washington it is an activity of the Pacific Northwest Forest and Range Experiment Station at Portland, Oregon.

Under the initial phase of the Forest Survey the forests of Grays Harbor County were inventoried in 1932. Later the inventory was adjusted to March 1, 1933 and a statistical report "Forest Statistics for Grays Harbor County, Washington" and a detailed forest type map--scale 1 inch to the mile--were released. In 1937 the first reinventory of the county's forests was made and a revised statistical report and forest type map prepared.

Following the second reinventory, in 1951, the forest type map has again been revised. 1/

1/ A print of the forest type map is available at cost of blueprinting. For information write Director, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Oregon.

CONTENTS

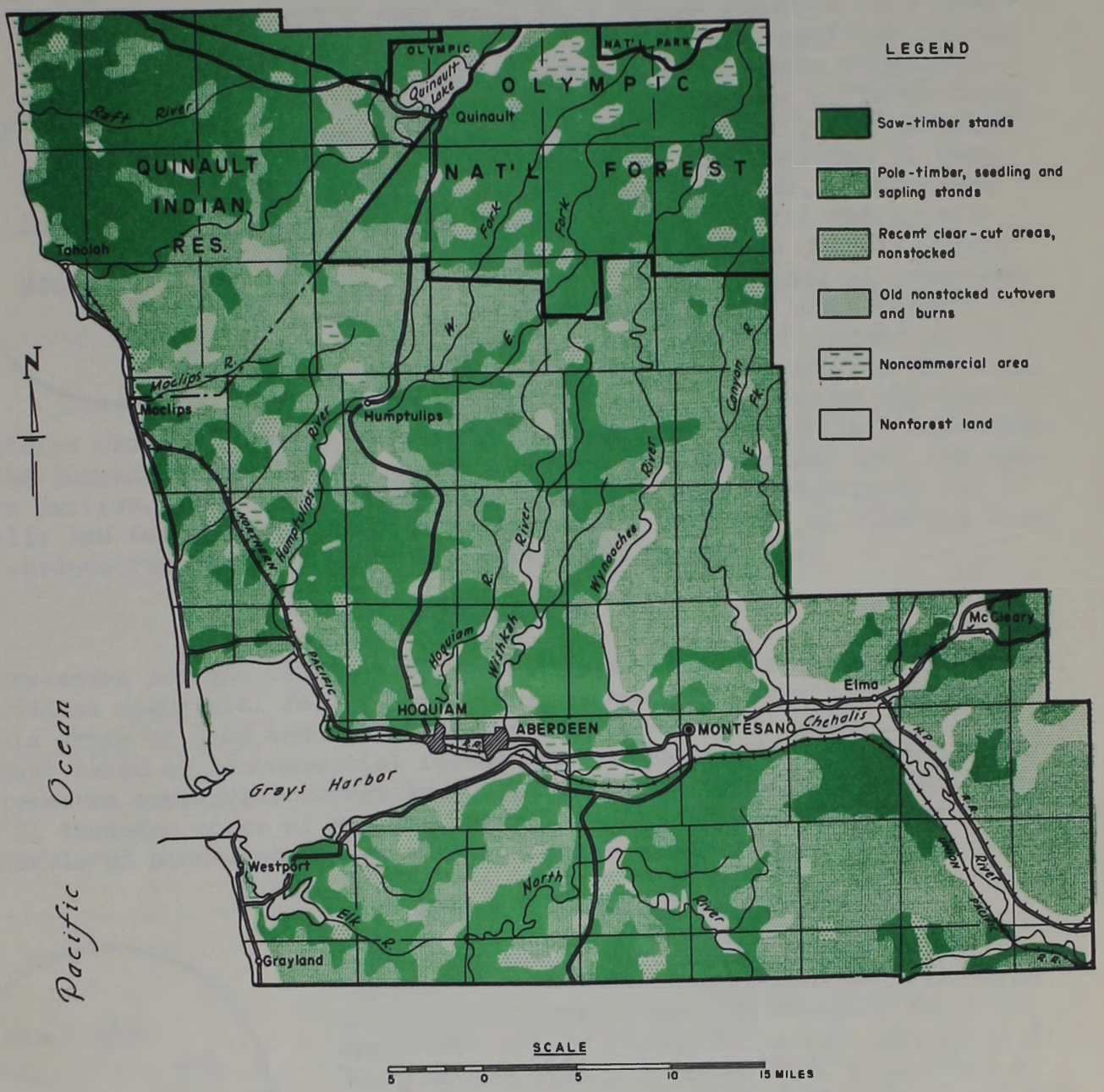
List of Tables

FIGURE 1

FOREST STAND-SIZE AND CONDITION CLASSES

GRAYS HARBOR COUNTY, WASHINGTON

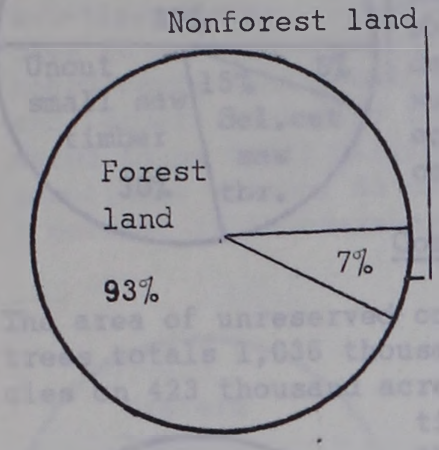
1951



SIGNIFICANT FINDINGS IN THE FOREST INVENTORY

LAND USE

Situated in southwest Washington with a coastal frontage of 50 miles and reaching inland from 30 to 50 miles, Grays Harbor County has a combination of physical conditions highly favorable for the growing of forest crops. The original forest stands, among the heaviest in the Pacific Northwest, covered all but a very small part of the county's land area.

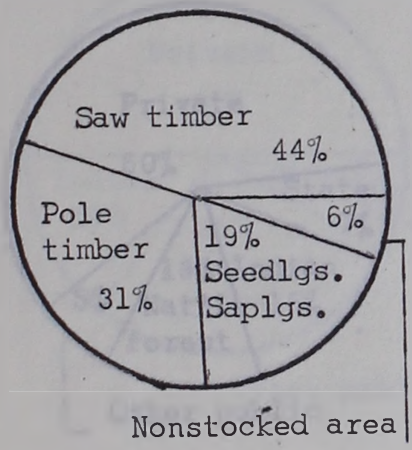


After a century of white settlement and including several decades of large-scale logging activity, the inventory classified 1,132 thousand acres of the total land area of 1,223 thousand acres, as forest land. The remaining 91 thousand acres, classed as nonforest, consists of 66 thousand acres in agricultural use chiefly on level valley lands along the Chehalis River (fig. 1), 7 thousand acres of natural grassland mostly along the seacoast, and 18 thousand acres in tideflats and town and industrial sites. Topography varies from rolling to rough, steep terrain. Several low spurs of the Coast Mountains cross the county from north to south and the southern extension of the rugged Olympic Mountains reaches some 15 to 20 miles into the northern portion. The forest soils rate high in timber productivity but usually low for the production of farm crops. High cost of clearing also discourages further conversion of forest land to farm use.

FOREST LAND

Ninety-seven percent of the 1,132 thousand acres of forest land was classed as commercial forest land, i.e., physically capable of producing usable crops of wood and not withdrawn from timber utilization. The 3 percent rated as noncommercial forest land consists of 13 thousand acres of reserved commercial forest land chiefly in the Olympic National Park, and 21 thousand acres of sterile, rocky, or high mountainous forest land incapable of producing timber of merchantable character.

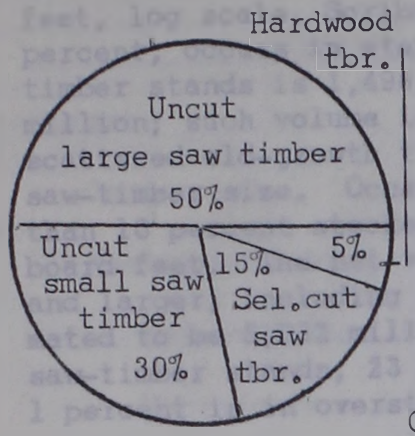
Stand-Size and Condition Classes



Classification of the 1,099 thousand acres of unreserved commercial forest land by stand-size or condition class found 485 thousand acres in saw-timber stands (trees 11" d.b.h. and larger). Young stands less than saw-timber size stock a large acreage; those of pole size (5"-11" d.b.h.) total 343 thousand acres; and those of seedling and sapling size (0"-5" d.b.h.) total 207 thousand acres. Of 63 thousand acres in a nonstocked condition, three-fifths is recently clear-cut land (cut 1940-51), and two-fifths is old cut-over land (cut prior to 1940).

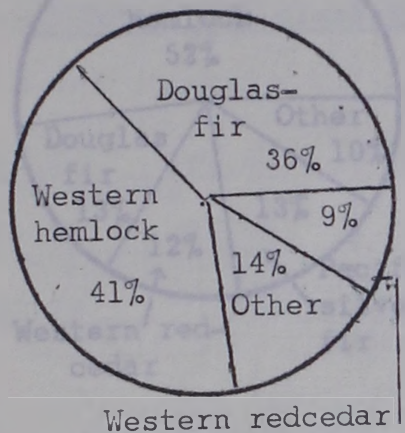
Character of Saw-Timber Stands

Of the 485 thousand acres of saw-timber stands, 245 thousand acres, very largely in the northern one-third of the county, is stocked with uncut stands of large conifer timber more than 21 inches d.b.h. There are 147 thousand acres of uncut stands of small conifer timber 11 to 21 inches d.b.h. located chiefly in the central portion of the county; also included are 71 thousand acres of selectively cut conifer timber in which the residual volume is 5 thousand board feet or more per acre. Such stands are chiefly in the southwestern portion. The remainder, 22 thousand acres, is stocked with pure hardwood timber more than 11 inches d.b.h.; the stands occur as small tracts along the larger stream courses.



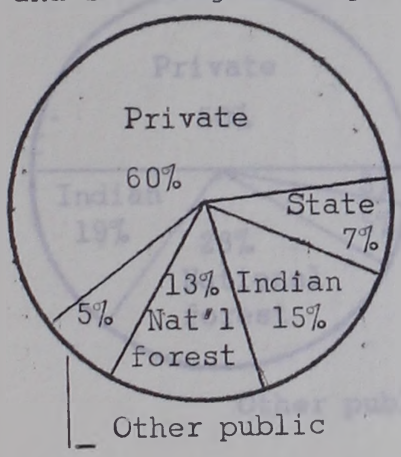
Commercial Forest Land by Type

The area of unreserved commercial forest land occupied with stands of trees totals 1,036 thousand acres. Western hemlock is the principal species on 423 thousand acres, more than half of which is stocked with saw-timber stands. Roughly one-quarter of the 376 thousand acres on which Douglas-fir is the predominant species, is in saw timber, one-half is in pole timber, and the remaining one-quarter is in seedlings and saplings. The area of western redcedar type located chiefly in the extreme northwest portion of the county, totals 92 thousand acres, two-thirds of which is in saw timber. "Other" types have a combined area of 146 thousand acres, of which 87 thousand acres is occupied by conifer types and 59 thousand acres with hardwood types.



Ownership of Commercial Forest Land

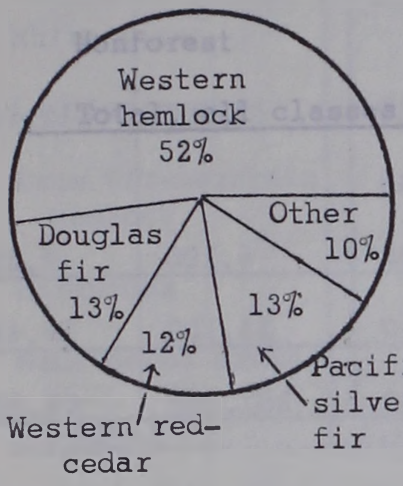
Private owners hold a total of 661 thousand acres including about one-half of the total saw-timber acreage, nearly three-fourths each of pole-timber and seedling-and-sapling acreages, and a little more than one-half of the nonstocked area. The State of Washington owns 75 thousand acres in this county, 14 thousand acres is in saw timber, 53 thousand acres is young stands, and the remainder is nonstocked. Indian tribal lands and trust allotments in the Quinault Indian Reservation amount to 165 thousand acres, 95 thousand of which is stocked with saw timber. National forest lands in the Olympic National Forest aggregate 138 thousand acres of which 122 thousand is in saw timber and the remainder is quite evenly divided between young-growth timber and nonstocked areas. The "other public" includes 46 thousand acres owned by the county and 13 thousand acres owned by municipalities.



TIMBER VOLUME

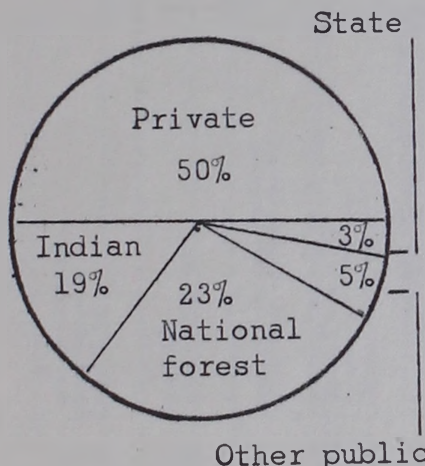
Net volume of live saw-timber trees (11 inches d.b.h. and larger) on unreserved commercial forest land is estimated to be 20,708 million board feet, log scale, Scribner rule. Of this volume 19,102 million feet, 92 percent, occurs in stands classed as saw timber. The volume in pole-timber stands is 1,498 million and in seedling and sapling stands 89 million; such volume is in the overstory of these young stands in either scattered old-growth trees or occasional dominant trees that have reached saw-timber size. Occasional trees on areas classed as nonstocked (less than 10 percent stocked) have an estimated total volume of 19 million board feet. The net volume of growing stock (live trees 5 inches d.b.h. and larger, including trees of both pole- and saw-timber size), is estimated to be 5,032 million cubic feet; 76 percent of this volume is in saw-timber stands, 23 percent is in pole-timber stands and the remaining 1 percent is in overstory trees of seedling and sapling stands.

Volume of Saw Timber by Species



The volume of softwood species totals 20,030 million board feet; the volume of hardwood species 678 million. The volume of western hemlock, 10,612 million, is quite evenly distributed by broad diameter classes: 24 percent is in trees 11"-21" d.b.h., 36 percent in 21"-31" class, 23 percent in 31"-41" class, and 17 percent in 41" plus class. Division of the 2,804 million of Douglas-fir by diameter class is: 38 percent in 11"-21" class, 13 percent in 21"-31" class, 8 percent in 31"-41" class, and 41 percent in 41" plus class. The volume of Pacific silver fir totals 2,721 million and western redcedar 2,588 million. Other conifers with saw-timber volume include Sitka spruce, western white pine, Alaska-cedar, mountain hemlock, and lodgepole pine. Red alder comprises practically all of the hardwood volume; there is a small amount each of bigleaf maple and black cottonwood.

Ownership of Saw-Timber Volume



Private owners as a class hold half of the saw-timber volume in the county; the other half is either publically owned or managed. The volume on national forest lands in the Olympic National Forest, managed by the Forest Service, amounts to 4,823 million board feet. Lands owned by Indians in the Quinault Indian Reservation and managed by the Indian Service support 3,937 million board feet of saw timber. The State of Washington has a total of 702 million board feet, and the volume in "other public" includes 662 million on county-owned lands and 278 million on municipally owned watersheds.

Table 1.--Land area by major classes of land, 1951

Class of land	Area
	Acres
Forest:	
Commercial	1,098,620
Noncommercial:	
Reserved from commercial timber use	12,710
Unproductive for timber use	20,830
Total	1,132,160
Nonforest	91,350
Total, all classes	1,223,510

Table 2.--Area of commercial forest land by ownership and stand-size class, 1951

Ownership class	Total	Saw-timber stands	Pole-timber stands	Seedling and sapling stands	Nonstocked areas
	Acres	Acres	Acres	Acres	Acres
Private	661,170	232,750	245,700	148,430	34,290
State	75,020	14,450	27,380	25,810	7,380
County	46,260	14,360	21,320	8,780	1,800
Municipal	13,050	6,480	5,100	1,470	
Federally owned or managed:					
Indian	165,380	95,230	41,010	17,000	12,140
Public domain	40		40		
National forest	137,700	122,220	2,090	6,100	7,290
Total Federal	303,120	217,450	43,140	23,100	19,430
All ownerships	1,098,620	485,490	342,640	207,590	62,900

Table 3.--Area of commercial forest land by major forest type and stand-size class, 1951

Forest type	Total	Saw-timber stands		Pole-timber stands	Seedling and sapling stands	Non-stocked areas
		Old growth	Young growth			
	Acres	Acres	Acres	Acres	Acres	Acres
Douglas-fir	375,270	30,680	59,930	178,110	106,550	
Western hemlock	422,930	148,190	84,300	99,500	90,940	
Sitka spruce	27,320	16,230	4,380	6,230	480	
Western redcedar	91,930	60,060	9,790	18,320	3,760	
White pine	6,080	520	3,850	1,510	200	
Lodgepole pine	9,520		1,160	6,800	1,560	
True fir-mountain hemlock	43,890	43,170	720			
Hardwoods	58,780		22,510	32,170	4,100	
Nonstocked areas	62,900					62,900
Total	1,098,620	298,850	186,640	342,640	207,590	62,900

Table 4.--Area of commercial and noncommercial forest land and nonforest land by cover type and ownership class, 1951

(Acres)

Survey type symbol	Cover type	Total	Unreserved								Reserved				
			Total	Private	State	County	Municipal	Federally owned or managed			Total	State	Federally owned or managed		
								Indian	Public domain	National forest			National park	Lighthouse reservation	National forest
ALL LANDS															
	Forest land	1,132,160	1,118,320	669,740	75,060	47,140	13,050	167,890	40	145,400	13,840	310	12,020	40	1,470
	Nonforest land	91,350	90,620	86,840	520	310	170	990		1,790	730	120	610		
	Total	1,223,510	1,208,940	756,580	75,580	47,450	13,220	168,880	40	147,190	14,570	430	12,630	40	1,470
COMMERCIAL FOREST LAND															
D5	Douglas-fir large old-growth saw timber (yellow fir)	31,220	30,680	7,250				90		23,340	540		460		80
D4	Douglas-fir small old-growth and large young-growth saw timber (red fir)	7,670	7,140	4,560	1,150		10	320		1,100	530	90	440		
D3	Douglas-fir small young-growth saw timber	52,790	52,790	47,160	3,410	1,780	400			40					
D2	Douglas-fir pole timber	178,210	178,110	143,400	22,480	7,470	3,610	600	40	510	100	100			
D1	Douglas-fir seedlings and saplings	106,550	106,550	77,250	20,650	2,360	1,470	460		4,360					
H4	Western hemlock large saw timber	151,080	148,190	70,490	4,650	4,600	2,710	18,260		47,480	2,890	40	2,370		480
H3	Western hemlock small saw timber	84,420	84,300	66,880	3,470	6,760	3,130	2,110		1,950	120		120		
H2	Western hemlock pole timber	99,740	99,500	66,130	2,980	11,930	1,070	16,040		1,350	240		240		
H1	Western hemlock seedlings and saplings	91,190	90,940	66,670	4,480	6,060		12,430		1,300	250		250		
S4	Sitka spruce large saw timber	17,360	16,230	3,330		270		9,190		3,440	1,130		340	40	750
S3	Sitka spruce small saw timber	4,380	4,380	3,830	120	240		190							
S2	Sitka spruce pole timber	6,230	6,230	4,500	40	230	60	1,400		240					
S1	Sitka spruce seedlings and saplings	480	480	240											
C4	Western redcedar large saw timber	60,950	60,060	6,020	400			48,850		4,790	890		730		160
C3	Western redcedar small saw timber	9,790	9,790	1,700	440	260		7,390							
C2	Western redcedar pole timber	18,320	18,320	2,230		800		15,080		210					
C1	Western redcedar seedlings and saplings	3,760	3,760	1,130	160	360		1,910		200					
W4	White pine large saw timber	520	520	440				80							
W3	White pine small saw timber	3,850	3,850	730	80	40		3,000							
W2	White pine pole timber	1,510	1,510	40				1,470							
W1	White pine seedlings and saplings	200	200					200							
LP3	Lodgepole pine small saw timber	1,160	1,160	600				560							
LP2	Lodgepole pine pole timber	6,880	6,800	1,450		80		5,270			80	80			
LP1	Lodgepole pine seedlings and saplings	1,560	1,560	440				1,120							
FM4	True fir-mountain hemlock large saw timber	47,600	43,1	310	160			3,710		38,990	4,130		4,130		
FM3	True fir-mountain hemlock small saw timber	1,360	720							720	640		640		
HD4	Hardwood large saw timber	4,130	4,130	3,160	110	30		470		360					
HD3	Hardwood small saw timber	18,720	18,380	16,290	460	380	230	1,010		10	340		340		
HD2	Hardwood pole timber	32,470	32,170	27,950	1,880	810	360	1,150		20	300		300		
HD1	Hardwood seedlings and saplings	4,100	4,100	2,700	520			880							
X	Recent clear-cut area nonstocked	37,740	37,510	20,440	3,070	80		6,630		7,290	230		230		
XO	Old clear-cut area nonstocked	25,390	25,390	13,850	4,310	1,720		5,510							
	Total	1,111,330	1,098,820	661,170	75,020	46,260	13,050	165,380	40	137,700	12,710	310	10,890	40	1,470
NONCOMMERCIAL FOREST LAND															
NR	Noncommercial rocky	17,330	16,780	8,570	40	880		2,510		4,780	550		550		
SA	Subalpine	3,500	2,920							2,920	580		580		
	Total	20,830	19,700	8,570	40	880		2,510		7,700	1,130		1,130		
NONFOREST LAND															
A	Agriculture	65,960	65,690	65,440	120	50		50		30	270	40	230		
G	Grass and brush	7,250	7,130	6,030	40	220		640		200	120		120		
O	Open--nonvegetative	18,140	17,800	15,370	360	40	170	300		1,560	340	80	260		
	Total	91,350	90,620	86,840	520	310	170	990		1,790	730	120	610		

Table 5.--Area of commercial forest land by generalized forest type and ownership class, 1951

(Acres)

Generalized forest type	Total	Unreserved								Reserved				
							Federally owned or managed					Federally owned or managed		
		Total	Private	State	County	Municipal	Indian	Public domain	National forest	Total	State	National park	Lighthouse reservation	National forest
Conifer saw timber														
Types D3, D4, D5, H3, H4, S3, S4, C3, C4, W3, W4, LP3, FM3, and FM4.														
Uncut	403,060	391,890	156,480	9,740	11,040	3,520	93,020		118,090	11,170	130	9,530	40	1,470
Selectively cut	71,090	71,090	56,820	4,140	2,910	2,730	730		3,760					
Total	474,150	462,980	213,300	13,880	13,950	6,250	93,750		121,850	11,170	130	9,530	40	1,470
Conifer pole timber														
Types D2, H2, S2, C2, W2, and LP2														
On cutovers	292,770	292,430	215,010	25,500	20,510	4,740	24,970	40	1,660	340	100	240		
On burns	17,800	17,720	2,540				14,890		290	80	80			
On plantations	320	320	200						120					
Total	310,890	310,470	217,750	25,500	20,510	4,740	39,860	40	2,070	420	180	240		
Conifer seedlings and saplings														
Types D1, H1, S1, C1, W1 and LP1														
On cutovers	174,670	174,420	128,190	17,630	8,700	1,470	16,120		2,310	250		250		
On burns	240	240	240											
On plantations	28,830	28,830	17,300	7,660	80				3,790					
Total	203,740	203,490	145,730	25,290	8,780	1,470	16,120		6,100	250		250		
Recent clear-cut areas, nonstocked														
Type X	37,740	37,510	20,440	3,070	80		6,630		7,290	230		230		
Old clear-cut areas, nonstocked														
Type XO	25,390	25,390	13,850	4,310	1,720		5,510							
Hardwoods														
Types HD1, HD2, HD3, and HD4	59,420	58,780	50,100	2,970	1,220	590	3,510		390	640		640		
Total	1,111,330	1,098,620	661,170	75,020	46,260	13,050	165,380	40	137,700	12,710	310	10,890	40	1,470

Table 6.--Net volume of live saw timber[1/] and growing stock[2/] on commercial forest land by ownership class, 1951

Ownership class	Saw timber		Growing stock
	Million board feet, log scale, Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Private	10,306	11,150	2,697
State	702	761	212
County	662	718	187
Municipal	278	300	69
Federally owned or managed:			
Public domain	3/	3/	4/
Indian	3,937	4,250	894
National forest	4,823	5,198	973
Total Federal	8,760	9,448	1,867
All ownerships	20,708	22,377	5,032

1/ Includes live trees 11.0 inches diameter breast height and larger measured in board feet.

2/ Includes live trees 5.0 inches diameter breast height and larger measured in cubic feet.

3/ Less than 500 thousand board feet.

4/ Less than 500 thousand cubic feet.

Table 7.--Net volume of live saw timber and growing stock on commercial forest land by stand-size class, 1951

Stand-size class	Saw timber		Growing stock
	Million board feet, log scale, Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Saw-timber stands	19,102	20,588	3,828
Pole-timber stands	1,498	1,671	1,165
Seedling and sapling stands	89	98	32
Nonstocked areas	19	20	7
Total	20,708	22,377	5,032

Table 8.--Net volume of live saw timber and growing stock on commercial forest land by species, 1951

Species	Saw timber		Growing stock
	Million board feet, log scale, Scribner rule	Million board feet, International ¼-inch rule	Million cubic feet
Softwoods:			
Douglas-fir	2,804	3,063	747
Western hemlock	10,612	11,461	2,541
Mountain hemlock	55	60	12
Sitka spruce	956	1,014	171
Western redcedar	2,588	2,744	551
Alaska-cedar	84	88	15
Western white pine	181	195	49
Lodgepole pine	29	33	8
Pacific silver fir	2,721	2,939	509
Total	20,030	21,597	4,603
Hardwoods:			
Red alder	663	763	391
Bigleaf maple	15	16	38
Black cottonwood	1/	1	2/
Total	678	780	429
All species	20,708	22,377	5,032

1/ Less than 500 thousand board feet.

2/ Less than 500 thousand cubic feet.

Note: Noble fir and grand fir also occur in the county but were missed in the randomly selected volume sample.

Table 9.--Net volume of Douglas-fir and western hemlock live saw timber on commercial forest land by diameter-class group and log rule, 1951

Diameter class and log rule	Total	Douglas-fir	Western hemlock
	Million bd.ft.	Million bd.ft.	Million bd.ft.
11.0" to 20.9" d.b.h.			
Scribner rule	3,594	1,068	2,526
International ¼-inch rule	3,967	1,239	2,728
21.0" to 30.9" d.b.h.			
Scribner rule	4,147	359	3,788
International ¼-inch rule	4,479	388	4,091
31.0" to 40.9" d.b.h.			
Scribner rule	2,661	220	2,441
International ¼-inch rule	2,869	233	2,636
41.0" d.b.h. and larger			
Scribner rule	3,014	1,157	1,857
International ¼-inch rule	3,209	1,203	2,006
All diameter classes			
Scribner rule	13,416	2,804	10,612
International ¼-inch rule	14,524	3,063	11,461

Table 10.--Net volume of all timber on commercial forest land by class of material and species group, 1951

Class of material	Total	Softwoods	Hardwoods
	Million cubic feet	Million cubic feet	Million cubic feet
Growing stock:			
Saw-timber trees:			
Sawlog portion	3,728	3,566	162
Upper stem portion	281	268	13
Total	4,009	3,834	175
Pole-timber trees	1,023	769	254
Total growing stock	5,032	4,603	429
Other material:			
Sound cull trees	11	11	
Rotten cull trees	44	44	
Salvable dead trees	78	78	
Total other material	133	133	
Total, all timber	5,165	4,736	429

Table 11.--Average annual commodity drain on live saw timber and growing stock on commercial forest land by species group for the period 1948-1951 incl.

Species group	Saw timber						Growing stock		
	Timber products	Logging residual	Commodity drain 1/	Timber products	Logging residual	Commodity drain 1/	Timber products	Logging residual	Commodity drain 1/
	Thousand board feet log scale, Scribner rule			Thousand board feet, International 1/4-inch rule			Thousand cubic feet		
Softwoods	402,658	9,905	412,563	432,357	10,636	442,993	75,279	8,537	83,816
Hardwoods	13,741	338	14,079	16,146	397	16,543	6,368	722	7,090
Total	416,399	10,243	426,642	448,503	11,033	459,536	81,647	9,259	90,906

1/ Total of timber-products output and logging residual. Timber-products output is the portion of the inventory volume removed from the woods; logging residual is the portion cut or killed in logging not removed from the woods.

FOREST SURVEY PROCEDURE

The procedures used in the second Forest Survey reinventory of Grays Harbor County were materially different from the procedures used in the initial inventory and first reinventory. This change in procedures accounts for some significant differences in both the forest-area and timber-volume statistics obtained. Therefore, a brief description of each of the procedures seems desirable.

Initial Inventory

The initial inventory of the county was conducted in 1932 by what was known as the "compilation method." In this method existing information on forest types, timber cruises, and other pertinent data were collected from private timber owners and various public agencies. These data were checked in the field for reliability, and were then adjusted to the specifications and standards of Forest Survey. Forest-type and timber-volume data for areas not covered by existing information were obtained through intensive field reconnaissance.

All land in the county was classified as either forest or nonforest. Forest land was further classified as commercial or noncommercial; the commercial forest land was still further classified by type, stand-size class and, in case of young-growth stands, by stocking and age classes. These types and classes were delineated on 1-inch-to-the-mile base maps of each township. These township type maps were then superimposed over ownership-status plats and dot-counted to obtain forest-type-area statistics by ownership class. Type delineations on the township maps were traced on a base map of the county to form a county forest type map.

In-place, timber-volume estimates were based on the existing cruise data collected from private and public sources, on field cruises, and on ocular estimates. Volume of young-growth saw timber was computed by applying yield-table values, adjusted for age of stand, stocking density, and site, to type acreages.

First Reinventory

The first reinventory, in 1937, included a complete revision of the forest type map of the county. For this revision, records of cutting and other forms of drain, since the original inventory, were obtained from various sources and verified in the field by ground reconnaissance. Areas on which the type had changed due to cutting, restocking of cut-over or burned-over land, and ingrowth of immature stands were remapped on the ground. The ownership status was brought up to date. On the basis of the new ownership data and the revised forest type map, area statistics by forest types were recomputed.

Timber volume estimates for virgin saw-timber stands were based on cruise data collected during the original survey, adjusted for cutting and other drain. Volume estimates for immature stands were determined from yield tables adjusted for site quality, age, and density of stands.

Second Reinventory

In the second reinventory, in 1951, complete revision of the forest type map was obtained through interpretation, classification, and mapping on aerial photos covering all of the land area. In the mapping on aerial photos, types whose classifications were in doubt and species composition of stands were checked in the field. The use of aerial photos in mapping resulted in type delineations of much greater accuracy and detail than were possible through the ground reconnaissance employed in the initial inventory and first reinventory. In the preparation of a revised type map, the delineations on the aerial photos were transferred to a 1-inch county base map through use of a photo projector. The new type map was then superimposed over a current ownership-status map of complete county coverage and a dot count made of forest type areas by ownership class.

Volume estimates each of live saw timber, growing stock, and salvable dead material were calculated by applying average per-acre volumes to the appropriate forest type acreages. The average per-acre volumes for saw-timber stands and pole-timber stands were obtained through a sampling procedure in which the stands were measured on randomly selected plots. Intensity of the sampling was so designed as to produce a total estimate of volume in the county of a specified sampling accuracy set by Forest Survey. In the random selection of samples each individual saw-timber or pole-timber stand in the county had an equal chance of being selected. A sample consisted of a cluster of 3 one-fifth-acre circular plots spaced at regular 6-chain intervals. A total of 172 plot clusters, or 516 one-fifth-acre plots was taken in saw-timber and pole-timber stands.

Average per-acre volumes for seedling and sapling stands and non-stocked areas were obtained through an aerial-photo-plot sampling procedure. A large number of one-acre photo plots was taken in a modified systematic-random pattern. By photo interpretation, estimates were made of average number of trees per acre of both saw-timber and pole-timber size, average crown diameter, and total tree height. Gross volume of the average tree was obtained from photo volume tables and then adjusted for defect and breakage in order to obtain net volume.

ACCURACY OF DATA

Forest Area

In the reinventory of the county, in-place mapping of the forests and their classification by forest type, stand-size class, or condition

class were on the basis of 100-percent coverage. Thus no error because of sampling was involved. Errors due to techniques or judgment in the field and in office computation of data were possible, but difficult to evaluate. Throughout all phases of the work close supervision and frequent checks assured a high level of accuracy and uniformity of standards.

Timber Volume

For the timber volume, derived from sampling surveys, the chances are two out of three that the estimated total saw-timber volume in the county does not vary in either direction from the true volume more than ± 4.81 percent; the estimated total growing-stock volume does not vary more than ± 4.44 percent.

COMPARISON OF INVENTORIES

Due to considerable differences in Forest Survey specifications, standards of utilization, and survey procedure, a direct comparison of most of the statistics from the 1951 reinventory as shown in tables 1 to 10, with those from the initial inventory in 1932 and first reinventory in 1937 is not possible. Some of the statistics can be compared after adjustments have been made for differences in specifications and standards.

Forest Land

The forest-land areas, classified by stand-size and condition classes, resulting from the three inventories, are shown in the table below. This comparison is based on the total area of commercial forest land in unreserved and reserved status in the county at the time of the inventory. The 1951 acreage by stand-size class shown in tables 2 and 3 is the area of only the unreserved commercial forest land.

Changes in Forest Land by Stand-Size and Condition Classes Between Inventories

Inventory	Total forest land	Commercial forest land (Unreserved and reserved)					Noncommercial forest land
		Total	Saw timber	Pole timber	Seedlings and saplings	Nonstocked area	
	Thousands of acres						
1932	1,150	1,078	510	133	141	294	72
1937	1,149	1,092	1/ 476	150	237	229	57
1951	1,132	1,111	2/ 497	343	208	63	21

1/ Including 56 thousand acres of selectively cut saw timber.
2/ " 71 " " " " " " "

With the exception of the seedling and sapling stands and nonstocked areas, the acreages for a given class are on a comparable basis. The saw-timber acreages, for instance, include stands 11.0 inches d.b.h. and larger; the pole-timber acreages include stands 5.0 to 10.9 inches d.b.h. The seedling and sapling acreages for all three inventories include stands from 0 to 4.9 inches d.b.h., but those for 1932 and 1937 do not include stands on areas clear-cut in the prior 10 years that were restocked at time of the inventory; such land was included in the nonstocked class. The 1951 acreage does include the area of seedling and sapling stands on recently clear-cut land, cut in prior 10 years, if they were found to be established at time of the inventory. This difference in classification procedure has a corresponding effect on the acreages of nonstocked areas--the 1932 and 1937 acreages included all recently clear-cut land, cut in prior 10 years, regardless of status of restocking at time of inventory; the 1951 acreage does not include the area of such land as had become restocked or had advanced growth in 1951.

The small decrease in saw-timber acreage during the 19 years from 1932 to 1951 does not appear reasonable in a county in which the annual area logged has been generally from 10 to 15 thousand acres. However, a very large part of the decrease of area due to logging has been offset by the ingrowth of stands from the pole-timber class. Also, some 50 thousand acres of poorly drained site, chiefly in the Quinault Indian Reservation and supporting stands of low-quality western redcedar, classified as noncommercial in 1932, was judged to be saw timber of commercial character in 1951. The saw-timber area in 1951 also included 71 thousand acres of selectively cut stands in which the residual volume was sufficient to classify the stand as saw timber.

The decrease of 18 thousand acres in total forest land during the 19 years was due in part to land clearing for agriculture, industrial and town expansion, and power-transmission lines and in part to a difference in classification of stump lands that are grazed.

Timber Volume

Direct comparison of the total timber volume obtained in the 1951 inventory with the volumes obtained in the 1932 and 1937 inventories is not possible. One reason is that the minimum diameter specification for saw timber which was 15 inches in the 1932 and 1937 inventories was lowered to 11 inches in 1951. A second reason is that during the 19-year interval there had been much intensification of timber utilization on logging operations; in recent years more of the gross stand volume is being removed from the woods as timber products. In the 1951 inventory this intensification was accounted for by using volume tables that gave significantly greater values for a tree of a given size than did the tables used in the two earlier inventories. A third reason is the inclusion in 1951 of the volume in scattered trees in the overstory of

pole, seedling and sapling stands and including a small volume on cut-over and burned-over lands classed as nonstocked. And still another reason is the inclusion in 1951 of the timber volume on 50 thousand acres of stands which in 1932 were judged to be of noncommercial character with no merchantable timber volume.

A comparison of board-foot volumes in saw-timber trees in saw-timber stands only is possible after they are put on the same basis of specifications and standards. The 1932 unreserved and reserved volume adjusted to the 11-inch minimum diameter of saw-timber trees and in terms of the volume tables used in the 1951 reinventory would have been 23,490 million board feet, log scale, Scribner rule; the corresponding volume in 1951 was 19,102 million, a decrease of 19 percent.

Comparison of the total cubic-foot volume of growing stock obtained in 1932 with the volume in 1951 is quite feasible due to only slight differences in specifications and standards of utilization between inventories. The total volume of all trees 5.0 inches d.b.h. and larger in all stands, in both unreserved and reserved ownerships, was 4,654 million cubic feet; in 1951 it totaled 5,125 million, an increase of 10 percent.

DEFINITION OF TERMS USED

Land Area

Total Land

Includes dry land and unmeandered water surface.

Forest Land

Includes (a) land which is at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; and (b) land from which the trees described in "(a)" have been removed to less than 10-percent stocking and which has not been developed for other use. Minimum area of forest land recognized in reinventory of the county was 10 acres.

Nonforest Land

Land that does not qualify as forest land. Minimum area recognized in the reinventory of the county was 10 acres.

Forest Land Classes

Commercial Forest Land

Forest land which is producing, or is physically capable of producing, usable crops of wood, economically available now or prospectively, and not withdrawn from timber utilization.

Reserved from Commercial Timber Use

Forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualified as commercial forest land.

Noncommercial Forest Land

Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land and (b) incapable of yielding usable wood products (usually saw timber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Unproductive for Timber Use

Forest land incapable of yielding usable wood products (usually saw timber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Forest Types

Forest Type

A forest stand characterized by the predominance of certain key species--in terms of cubic volume for saw-timber and pole-timber stands, and in number of trees for seedling and sapling stands--or a forest condition such as nonstocked cut-over or burned-over land. The generalized forest types listed in table 3 are of the following composition:

Douglas-fir. Stands comprised of 50 percent or more of Douglas-fir by cubic volume or number of trees.

Western hemlock. Stands comprised of 50 percent or more of western hemlock by cubic volume or number of trees.

Sitka spruce. Stands comprised of 50 percent or more of Sitka spruce by cubic volume or number of trees.

Western redcedar. Stands comprised of 40 percent or more of western redcedar by cubic volume or number of trees.

White pine. Stands comprised of 20 percent or more of western white pine by cubic volume or number of trees.

Lodgepole pine. Stands comprised of 50 percent or more of lodgepole pine by cubic volume or number of trees.

True fir-mountain hemlock. Stands in which either Pacific silver fir, noble fir, or mountain hemlock, or any combination of these species, comprise 50 percent or more of the cubic volume or number of trees.

Hardwoods. Stands comprised of 50 percent or more of one of the merchantable hardwood species.

Nonstocked areas. Cut-over or burned-over areas on which the restocking, if any, is less than 10 percent density and which does not support a residual stand meeting minimum saw-timber requirements.

Tree Classes

Saw-Timber Tree

Softwood or hardwood tree 11.0 inches d.b.h. or larger containing at least one 16-foot log to a variable top diameter inside bark approximating 40 percent of diameter breast height, but never less than 8 inches, and in which 25 percent or more of the gross board-foot volume is free from rot and defect.

Pole-Timber Tree

Softwood or hardwood tree 5.0 to 10.9 inches d.b.h. in which 25 percent or more of the gross cubic-foot volume is free from rot and defect.

Cull Tree

Live tree of saw-timber or pole-timber size that is unmerchantable, now or prospectively, because of defect or rot.

Sound cull tree. Live tree of saw-timber or pole-timber size which contains 25 percent or more of sound volume but will not make at least one merchantable log, now or prospectively, because of roughness or poor form.

Rotten cull tree. Live tree of saw-timber or pole-timber size in which less than 25 percent of the total volume is sound.

Salvable Dead Tree

Standing dead or down tree which contains 25 percent or more of sound volume and at least one merchantable log.

Stand-Size Classes

Saw-Timber Stand

Stand of saw-timber trees having a minimum net volume per acre as follows: 5,000 board feet, log scale, Scribner rule, in any species except the pines and hardwoods; 1,500 board feet in the pines and hardwoods.

Old-growth saw-timber stand. Stand in which the majority of the cubic-foot volume is in trees more than about 180 years of age and larger than 21.0 inches d.b.h.

Large old-growth saw-timber stand. Stand in which the majority of the volume is in trees more than 41.0 inches d.b.h.

Young-growth saw-timber stand. Stand in which the majority of the cubic-foot volume is in trees under about 180 years of age and from 11.0 inches to 40.9 inches d.b.h.

Pole-Timber Stand

Stand failing to meet saw-timber-stand specifications but of at least 10-percent stocking of trees 5.0 inches d.b.h. and larger, with at least one-half the minimum stocking in pole-timber trees (5.0 inches to 10.9 inches d.b.h.).

Seedling and Sapling Stand

Stand not qualifying as either saw-timber or pole-timber stand but having at least 10-percent stocking of trees and with at least one-half the minimum stocking in seedlings and saplings (0-inch to 4.9 inches d.b.h.).

Uncut Saw-Timber Stand

Stand that is essentially undisturbed by cutting.

Selectively Cut Saw-Timber Stand

Stand in which a partial harvest has been made, and in which the residual volume amounts to 5 thousand board feet per acre or more.

Timber Volume

Live Saw-Timber Volume

Net volume in board feet of live saw-timber trees:

Scribner rule. The common board-foot rule used in determining log-scale volume of saw timber in this region. This rule underestimates, particularly in case of timber of the smaller diameters, the volume of lumber that could be produced from the timber.

International $\frac{1}{4}$-inch rule. The standard board-foot rule adopted by the Forest Service in the presentation of Forest Survey volume statistics. Volumes in this rule approximate lumber tally.

Growing Stock

Net volume in cubic feet of live saw-timber trees and live pole-timber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

Salvable Dead

Dead trees, standing or down, in which at least one-third of the gross volume is free from rot or defect and in which sound volume totals at least 30 board feet.

Saw-Timber Volume

Net volume in board feet of live and salvable dead saw-timber trees to a merchantable top.

All-Timber Volume

Net volume in cubic feet of live and salvable dead saw-timber trees and pole-timber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top inside bark.

Commercial Tree Species

Tree species that are considered in determining stocking of stands and growing-stock volume. Includes species presently or prospectively usable for commercial timber products.

Commercial tree species in Grays Harbor County include:

Softwoods:

Douglas-fir (Pseudotsuga taxifolia).
Western hemlock (Tsuga heterophylla).
Mountain hemlock (Tsuga mertensiana).
Sitka spruce (Picea sitchensis).
Western redcedar (Thuja plicata).
Alaska-cedar (Chamaecyparis nootkatensis).

Softwoods (Con.)

Western white pine (Pinus monticola).
Lodgepole pine (Pinus contorta).
Pacific silver fir (Abies amabilis).
Noble fir (A. procera).
Grand fir (A. grandis).

Hardwoods:

Red alder (Alnus rubra).
Bigleaf maple (Acer macrophyllum).
Black cottonwood (Populus trichocarpa).

Commodity Drain

Commodity Drain on Live Saw Timber

Board-foot volume of live saw-timber trees removed from commercial forest land during a specified year as timber products and that left as logging residue.

Timber-products output. The live saw-timber volume entering into timber products during a specified year.

Logging residue. The live saw-timber volume that is cut or killed in logging during a specified year but is not removed from the forest as timber products.

Commodity Drain on Growing Stock

The cubic-foot volume of live saw-timber and pole-timber trees removed from commercial forest land during a specified year as timber products and left as logging residue.

Timber-products output. The growing stock volume entering into timber products during a specified year.

Logging residue. The volume of growing stock that is cut or killed in logging during a specified year but is not removed as timber products.

Comparison of Inventories

Ingrowth

The volume, or number, of trees that have grown past the specified lower-diameter limit of a stand-size class.